A-39

X-ray Characterization of Rhenium Speciation in Supported Pd/Re Catalysts for Aqueous Perchlorate Treatment

Jong Kwon Choe[1], Kenneth Kemner[2], Maxim Boyanov[2], Charles J. Werth[1], John R. Shapley[3], and Timothy J. Strathmann[1]

[1]Department of Civil and Environmental Engineering, University of Illinois at Urbana Champaign, Urbana, IL 61801
[2]Environmental Research Division, Argonne National Laboratory, Argonne, IL 60439
[3]Department of Chemistry, University of Illinois at Urbana Champaign, Urbana, IL 61801

Perchlorate is a widespread contaminant detected in groundwater and surface water throughout the United States. Strict drinking water regulations are anticipated due to its health effects and growing public concerns, so there is a need for technologies that effectively treat perchlorate-contaminated water. Recent work at the University of Illinois demonstrates that heterogeneous palladium/rhenium (Pd-Re) bimetal catalysts reduce aqueous perchlorate to chloride using hydrogen as electron donor at ambient temperature and pressure orders-of-magnitude faster than other chemical reduction processes. The proposed mechanism for catalytic perchlorate reduction assumes redox cycling of Re on the surface of the catalyst, and recent work suggests that immobilization and stability of Re is dependent on solution redox condition. This presentation will describe recent efforts to characterize the Re surface and bulk speciation on the bimetal catalyst under different operating conditions (e.g., exposure to hydrogen- versus air-saturated water) and assess how Re coordination is influences by these variables. The results of x-ray photoelectron spectroscopy measurements and preliminary analysis of Re L3-edge x-ray absorption near edge structure and extended x-ray absorption fine structure data collected at the Advanced Photon Source will be presented, and results will be used to interpret the molecular properties of catalytically active Re species.